WHAT IS CLAIMED IS:

1. A system for detecting ultrasonic displacements in a material under test, comprising:

a seed laser light source that provides a first laser beam having a path of propagation;

a modulator assembly placed in said path of said first laser beam operable to provide an output pulse having a time-dependent pulse profile;

an ultrasonic induction system which induces ultrasonic displacements in the material under test;

a detection system which applies said output pulse of said first laser beam to the material under test in order to detect the ultrasonic displacements and generate at least one output signal; and

a data processor to process said at least one output signal of said detection system to obtain data representative of said ultrasonic displacements.

2. The system of Claim 1, wherein said modulator assembly further comprises an electro-optic crystal driven by a signal processor for providing said output pulse with a time-dependent pulse profile.

3. The system of Claim 1, wherein said time-dependent pulse profile substantially matches an attenuation characteristic of the material under test.

4. The system of Claim 1, wherein said time-dependent pulse profile provides sufficient variation in intensity to alter a dynamic range of said detection system.

5. The system of Claim 1, wherein the ultrasonic induction system further comprises:

a second laser to generate a second pulsed laser beam wherein said second pulsed laser beam induces ultrasonic displacements in the material under test.

6. The system of Claim 5, wherein said second pulsed laser beam is applied coaxially with said first pulsed laser beam to the material under test and a profile of said second pulsed laser beam is synchronized with said time-dependent pulse profile.

7. The system of Claim 1, further comprising at least one optical isolation assembly placed in said path of propagation of said first laser beam in order to prevent reflected laser light feedback into said seed laser light source.

8. The system of Claim 7, further comprising at least one optical beam dump positioned with respect to said at least one optical isolation assembly in order absorb reflected laser light feedback isolated by the optical isolation assembly.

9. The system of Claim 1, further comprising at least one laser light amplification assembly placed in said path of propagation of said first laser beam for amplifying said first laser beam.

10. The system of Claim 1, wherein said data processor converts at least one analog output signal of said detection system into at least one digital signal to obtain data representative of ultrasonic displacements in the material under test.

11. A system for detecting ultrasonic displacements in a material under test comprising:

a seed laser light source that provides a first laser beam having a path of propagation;

a modulator assembly placed in said path of propagation operable to provide for time-varying of output pulse having a time-dependent pulse profile;

a controller operable to direct said modulator assembly;

at least one optical isolation assembly placed in said path of propagation that prevents reflected laser light feedback into said seed laser light source;

at least one optical beam dump positioned with respect to said at least one optical isolation assembly in order absorb reflected laser light feedback isolated by said optical isolation assembly;

at least one laser light amplification assembly placed in said path of propagation in order to amplify said first laser beam;

an ultrasonic induction system which induces ultrasonic displacements into the material under test;

a detection system which applies said output pulse to the material under test, detects ultrasonic displacements in the material under test, and generates at least one output signal; and

a data processor to process said at least one output signal in order to obtain data representative of said ultrasonic displacements in the material under test.

12. The system of Claim 11, wherein said time-dependent pulse profile substantially matches an attenuation characteristic of the material under test.

13. The system of Claim 11, wherein an intensity of said time-dependent pulse profile alters a dynamic range of said detection system.

14. The system of Claim 11, wherein said modulator assembly further comprises an electro-optic crystal driven by a processor to provide said time-dependent pulse profile.

15. The system of Claim 11, wherein said ultrasonic induction system further comprises:

a second laser source that generates a second pulsed laser beam that induces ultrasonic displacements when applied to the material under test.

16. The system of Claim 11, wherein said ultrasonic induction system further comprises:

a second laser source that generates a second pulsed laser beam that induces ultrasonic displacements in the material under test, and wherein said second pulsed laser beam is applied coaxially with said first pulsed laser beam to the material under test, and wherein a pulse profile of said second pulsed laser beam is synchronized with said time-dependent pulse profile of said first laser beam.

17. The system of Claim 11, wherein said data processor converts said at least one output signal of said detection system into at least one digital signal and processes the at least one digital signal to obtain data representative of ultrasonic displacements in the material under test.

18. The system of Claim 11, wherein said data processor processes said at least one analog output signal of said detection system in order to determine a location of a flaw or discontinuity within the material under test.

19. A method for detecting ultrasonic displacements in a material under test, comprising the steps of:

generating the ultrasonic displacements in the material under test;

generating a first laser pulse having a time-dependent pulse profile;

applying said first laser pulse to the material under test;

detecting the laser light of said first laser pulse modulated by the ultrasonic displacements at the material under test; and

converting said modulated laser light into at least one output signal containing data representative of the ultrasonic displacements in the material under test.

20. The method of Claim 19, wherein said step of generating a first laser pulse further comprises the steps of:

generating a first laser beam from a seed laser light source, wherein said first laser beam has a path of propagation; and

modulating said first laser beam with a modulator assembly placed in said path of propagation of said first laser beam, said first laser pulse having said time-dependent pulse profile.

21. The method of Claim 19, further comprising amplifying said first laser pulse with at least one laser light amplification assembly.

22. The method of Claim 20, wherein said step of modulating said first laser beam comprises:

modulating said first laser beam with an electro-optic phase modulator; and

using a controller to drive the electro-optic phase modulator to produce said time-dependent pulse profile;

23. The method of Claim 23, wherein said controller drives said modulator to produce a profile for said time-dependent pulse profile selected from the group consisting of:

a gaussian or lorentzian pulse shape;

a flat profile with a linear ramp pulse shape; and

an exponential gain pulse shape.

24. The method of Claim 19, wherein said at least one signal is an optical signal, and wherein the step of converting the at least one signal into data representative of the ultrasonic displacements in the material under test further comprises:

converting the at least one optical signal into at least one analog signal;

converting the at least one analog signal into at least one digital signal; and

converting the at least one digital signal into data representative of the ultrasonic displacements in the material under test.

25. The method of Claim 19 further comprising processing said output signal to determine a location of flaws or any discontinuities at the target.